the standpoint of disturbance experienced by the electrified double layer. The waterfall theory of thunderstorms now appears probable since the discrepancies hitherto attached to it have been removed by the preceding results. A large number of singularities accompanying the waterfall effect, together with the photoelectric activity and the surface tension of different fluids, can be traced to their surface conditions.—*H. H. Ho[dgson]*.

GAGE APERTURE AND WEIGHT OF CATCH.

By Prof. CHARLES N. HASKINS.

[Dated: Dartmouth College, Hanover, N. H., Nov. 20, 1915.]

In connection with the problem of determining snowfall or rainfall by weighing, I note the following simple relation which seems to be of interest in that it enables private observers to determine the precipitation in this way without the use of specially graduated balances. The relation is: If the diameter of the gage is 10.5 inches, the rainfall in hundredths of an inch is equal to twice the weight of the catch in ounces. This relation is true to within about 1 part in 2,500, which is of course of ample precision. The proof of this results from a simple calculation.

ATMOSPHERIC-ELECTRIC OBSERVATIONS ON THE THIRD CRUISE OF THE "CARNEGIE," 1914.[1]

By W. F. G. SWANN.

[*Reprinted from* Science Abstracts, Sec. A, Oct. 25, 1915, § 1317.]

The general course covered by the cruise was from Brooklyn (left June 8) to Hammerfest in northern Norway; from Hammerfest (July 25) northward to latitude 79° 52′ N. in the neighborhood of Spitsbergen, and then southwestward to Reykjavik in Iceland (Aug. 24), and so back to Brooklyn. The measurements discussed in the present report are those of potential gradient, conductivity, and the radio-active content of the air. Potential gradients were measured by the use of an ionium collector projecting from the stern of the ship connected to a Wulf bifilar electroscope. The standardization of this apparatus was carried out by means of simultaneous ship and shore observations on two occasions. The conductivity was measured by Gerdien's method, and a few observations were also taken of the ionic numbers. The radio-active content was measured by the stretched-wire method of Elster and Geitel with certain modifications devised by the author. There is some uncertainty as to what the measurements obtained by this method really mean, and a considerable amount of discussion is devoted to the point.

The mean potential gradient found on the voyage was 93 volts per meter. The measurements were made between 9 a. m. and noon, at which period of the day Simpson and Wright found in the South Atlantic a mean value of 80 volts per meter; so that, considering the difficulties in the way of obtaining absolute readings, there is a fair agreement between the two results. The mean conductivity was 2.52×10^{-4} electrostatic unit. This is rather greater than the average value found on land. Passing out to sea from the American shore, the conductivity appears first to fall somewhat below the normal land value, and then increases again as the vessel gets out into the open sea. This distribution was observed both on leaving and returning to the shore. The local decrease near the shore is found to be due to a low value of the specific velocity of the ions in the same region. The electrical results have been grouped in various ways with the different meteorological elements, but no marked relationships are found. In discussing the radio-active content, the mean value expressed in Elster-and-Geitel units is found to be 23, corresponding to about 12×10^{-12} curie of radium emanation per cubic meter. This amount is much smaller than would be necessary to account for the conductivity of the air. A similar result has been found by most observers. In the latter portion of the paper an application of the theory of radio-active disintegration is made to the decay curves obtained in the Elster-and-Geitel method, and it is found that while some of the curves can be accounted for by the presence of radium emanation alone in the atmosphere, others appear to require the presence of some more slowly decaying products than those of radium emanation.—*J. S. Di[nes]*.

[1] *See* Terrest. magn., March 1915, 20: 13–48.

FOGGY DAYS IN MANCHESTER, ENGLAND.[1]

By W. C. JENKINS.

[*Reprinted from* Science Abstracts, Sec. A, Oct. 25, 1915, § 1377.]

An inquiry as to whether the number of foggy days in Manchester [England], has increased or decreased in the past 10 years. A distinction is drawn between "fog days" or days of surface fog, and "gloom days" or days on which there was fog at a little distance above the surface but not actually on the ground. The figures for the 10 years are arranged in various ways, and it is found that taking the year as a whole the number of foggy and gloomy days combined has increased 30% between the beginning and ending of the period. The most marked part of this increase is in the number of days of gloom.—*J. S. Di[nes]*.

PHYSICAL CONDITIONS OF THE ACCUMULATION OF THE SUN'S HEAT IN THE SALT SEAS.[2]

By M. RÓZSA.

[*Reprinted from* Science Abstracts, Sec. A, Oct. 25, 1915, § 1381.]

The investigation of the accumulation of the sun's heat in some salt seas was first undertaken by Kalecsinzky, and the problem in general solved. In the present paper a report is given of the special physical conditions of the warming process, and some experimental researches in connection with this. It is found that a considerable accumulation of the sun's heat can only occur in those salt seas in which the upper layers increase in concentration in consequence of a more permanent diffusion process.—*A. E. G[arrett]*.

ABSORPTION OF ULTRA-VIOLET AND INFRA-RED RADIATIONS BY ARABLE SOIL.[3]

By J. F. TRISTAN and G. MICHAUD.

[*Reprinted from* Science Abstracts, Sec. A, Aug. 30, 1915, § 982.]

Photographs were taken in ultra-violet light through a quartz lens, silvered after Liebig, which is transparent to light of from 3100 to 3300 Å units. For the photo-

[1] *See* Mem. Manchester lit. and phil. soc., Apr. 30, 1915, No. 5, 59: 1–4.
[2] Physik. Zeits., Mar. 15, 1915, 16: 109–111.
[3] *See* Archives des sciences, March, 1915, p 270–273.

graphs in the infra-red Wood's filters are used, made by Wratten and Wainwright; the preparation of these plates is described. The method for determining the absorption of the light by the soil is not explained at all. Eight pairs of photographs are reproduced showing the darkening of the plates by ultra-violet and by infra-red light, in each case by four soils (calcareous, sandy, clay, humus), in the dry or humid state. The dry soil absorbed much less infra-red light than the humid soil; this effect of moisture, which was most marked in the case of clay soil, was much less noticeable in the case of ultra-violet light.—*H. B[orns]*.

DENSITY OF OXYGEN.[1]

By A. F. O. GERMANN.

[*Reprinted from* Science Abstracts, Sec. A, Aug. 30, 1915, § 1149.]

This paper contains, first of all, a historical survey of the determinations of the density of oxygen, and a description of the special apparatus employed. As a result of his determinations with oxygen, prepared by heating potassium permanganate and purified by liquefaction and fractional distillation, the author obtains the value for the weight of a normal liter of oxygen (at 0°C. and under a pressure of 760 mm. of mercury in latitude 45° at sea-level), of 1.42906 gm. Taking into account the previous determinations of Morley and of Rayleigh, but giving rather more weight to his own determination, the author believes that the most probable value for the weight of a normal liter of oxygen, $L_N = 1.42905$ gm.—*A. Fi[ndlay]*.

ORDINARY AND INTERNAL SEICHES IN LAKE TASAWA.[2]

By K. HONDA.

[*Reprinted from* Science Abstracts, Sec. A, Aug. 30, 1915, §985.]

As in previous investigations, the author constructed a model of this the deepest Japanese lake before making the actual observations, and found experimentally four periods for the fundamental and higher modes of oscillations. Generally speaking, the seiches are most conspicuous in deep lakes, and seldom observable in shallow, but here only faint undulations were detected, using Honda's limnimeters for this purpose. The following causes are given for these inconspicuous seiches in such a deep lake: (1) The form of the lake being nearly circular there is no direction of easy oscillation; (2) surrounded on all sides by steep mountains the lake is generally very calm; (3) the depth being so great, a strong exciting cause is required to make the whole water oscillate.

For the observation of the internal seiches, a Miller pattern deep-sea thermometer, which indicates the maximum and minimum temperatures, was used. An adequate description of the operations is given and the following results obtained: Near the surface the fall of temperature is gradual, but at a depth from 10 to 16 meters is very rapid; afterward it becomes again very slow, tending asymptotically to the temperature of the maximum density of water, 4°C. The usual explanation for the existence of this apparent discontinuous layer is that near the surface the temperature is equalized by the disturbing effect of currents and the waves in the lake. The depth to which the disturbance reaches depends upon its duration, increasing with the period of disturbances. Down to this depth the fall of temperature is very gradual, but the conduction of heat being very small, the fall of temperature in a depth deeper than that where the disturbance nearly vanishes follows a logarithmic law with respect to the depth. Hence the fall is at first very gradual, then very rapid, and afterward becomes more and more slow, so that there is an apparent layer of discontinuity. Similar results are given for the lakes of Inawasiro and Towada. Tables of observations are given, and from the curves (temperature-time for constant depths and depth-time for constant temperatures) two periods are deduced for the approximate values of periods of internal seiches. A short mathematical discussion concludes the paper from which it follows that the two long periods recorded on the limnimeters are due to the internal seiches of the lake. Hitherto in the observations of the ordinary seiches, where the periods are large compared with the natural oscillations of the lakes, these are usually attributed to the effect of wind blowing with some periodicity of slow alternations. From the present investigation, however, the long periods are well explained by the internal seiches of the lakes.—*H. H. Ho[dgson]*.

ÆOLIAN TONES.[1]

By LORD RAYLEIGH.

[*Reprinted from* Science Abstracts, Sec. A, June 25, 1915, § 718.]

In what has long been known as the æolian harp, a stretched string, such as a pianoforte wire or a violin string, is caused to vibrate in one of its possible modes by the impact of wind; and it was usually supposed that the action was analogous to that of a violin bow, so that the vibrations were executed in the plane containing the direction of the wind. A closer examination showed, however, that this opinion was erroneous and that in fact the vibrations are transverse to the wind. Further, it is not essential to the production of sound that the string should take part in the vibration, and the general phenomenon, exemplified in the whistling of wind among trees has been investigated by Strouhal (1878) under the name of *Reibungstöne* [friction tones]. In Strouhal's experiments a vertical wire or rod attached to a suitable frame was caused to revolve with uniform velocity about a parallel axis. The pitch of the æolian tone generated by the relative motion of the wire and of the air was found to be independent of the length and of the tension of the wire, but to vary with the wire's diameter, D, and with the speed, V, of the motion. Within certain limits the relation between the frequency, N, and these data was expressible by

$$N = 0.185\ V \div D \quad \ldots \quad (1),$$

the centimeter and the second being units.

Other refinements are here considered and finally the following formula is given:

$$ND/V = 0.195\ (1 - 20.1\nu/VD),$$

where for air at about 20°C. the kinetic viscosity is $\nu = \mu/\rho = 1806 \times 10^{-7}/0.00120 = 0.1505$ c. g. s. For water at 15°C., $\nu = 0.0115$.

The formation of vortices in the fluid flowing past the wires is discussed and some preliminary experiments are described.

Further experiments are still, however, admittedly desirable.—*E. H. B[arton]*.

[1] *See* J. Phys. chem., June 19, 1915, p. 437-477.
[2] *See* Tôhoku Univ., Sci. Reports, 1915, p. 33-42.

[1] *See* Phil. mag., April, 1915, p. 433-444.